Stability of Drugs and Dosage Forms

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The moisture permeation rate of a sugar coating composed of sucrose, talc, and other minor components was reported to conform to Fick's equation.[729] The permeation rate appeared to be rate-controlling for moisture adsorption by sugar-coated tablets.

Moisture adsorption of dosage forms in relation to the moisture permeation of packaging will be described in Section 4.3.1.

4.2.8. Discoloration

Although the discoloration of dosage forms may result from chemical degradation, the mechanisms are usually unclear. Thus, discoloration is generally considered to be a physical degradation (degradation of "appearance"). Empirical equations such as the Weibull equation have been used to predict discoloration of some dosage forms. Discoloration of a parenteral formulation of ascorbic acid was described by the Weibull equation (Eq. 2.69), and the constants representing discoloration rate were obtained from the slopes (Fig. 186).[730] The fact that the kinetics also conformed to Arrhenius behavior (Fig. 187) suggested that it would be possible to predict discoloration rates under a variety of conditions.

Changes in crystallinity during storage of solid-state emulsions from which oil-in-water emulsions are prepared was reported.[731]

4.3. Effect of Packaging on Stability of Drug Products

The role that packaging plays in the overall perceived and actual stability of the dosage form is well established. Packaging plays an important role in quality maintenance, and the resistance of packaging materials to moisture and light can significantly affect the stability of drugs and their dosage forms. It is crucial that stability testing of dosage forms in their final packaging be performed.[732]

The primary role of packaging, other than its esthetic one, is to protect the dosage forms from moisture and oxygen present in the atmosphere, light, and other types of exposure, especially if these factors affect the overall quality of the product on long-term storage. Protection from light can be achieved using primary packaging (packaging that is in direct contact with the dosage forms) and secondary packaging made of light-resistant materials. Incorporating oxygen adsorbents such as iron powder in packaging units can reduce the effect of oxygen. Details on the contributions of packaging to the stability of dosage forms have been extensively presented elsewhere. This section will emphasize the effect of packaging on moisture adsorption as it affects the stability of dosage forms and consider the interaction between dosage forms and packaging.

4.3.1. Moisture Penetration

Many studies have been conducted on predicting the role of packaging in moisture adsorption by dosage forms. Adsorption of moisture by tablets contained in polypropylene films was successfully modeled from storage temperature and the difference in water vapor pressure between the inside and outside of the packaging, as shown in Fig. 188.[733] Similarly, the moisture adsorption of moisture by cloxazolam tablets through press through packaging (PTP) composed of polyvinyl chloride and on aluminum film under nonisothermal conditions was predicted from the moisture permeability coefficient of the packaging as well as from temperature and humidity conditions inside and outside the packaging.[734]